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Strongly correlated transport and edge states in dopant arrays in silicon NGUYEN LE, University of Surrey, ANDREW FISHER, University College London, ERAN GINOSSAR, University of Surrey — Advanced experimental techniques such as single-ion implantation and STM lithography have enabled the fabrication of deterministically placed dopants in silicon. We have studied theoretically the strongly correlated coherent transport in small arrays of Si:P. The array is described by an effective Hubbard model whose eigenstates are obtained by exact diagonalization, coupled by hopping to non-interacting leads. We study the tunnel coupling disorder caused by multi-valley interference and the dopants positional fluctuation. This disorder results in Lifshitz localization of the many-body wavefunction, which suppresses the charge transport through the array. The effect of long range inter-dopant Coulomb interactions in the system is also investigated. Finally, we show that topological edge states can be realised, and discuss the characteristics of the topological phase transition in a one-dimensional superlattice of Si:P.

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